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Field Crops
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High Moisture Barley

Grains reach maturity several days before harvest. To prevent spoilage, harvesting is normally delayed to allow the grain drying time in the field. If barley could be harvested when it reached maturity, rather than having to let it dry in the field, then harvests could be completed earlier with reduced field losses.

Tough grain, with a moisture content of 15.5 to 17.0 per cent when bin stored, may rot. Damp grain, with a moisture content greater than 17.1 per cent will rot quickly, often producing enough heat to start a fire. Spoiled grain is useless as feed since, during spoilage there is a risk of toxic chemical build-up from alfatoxins which are produced by soil micro-organisms. Alfatoxins endanger the health of both people and animals.

Micro-organic contamination occurs during both the growing season and harvest when dust becomes mixed with the grain. If damp grain is to be stored successfully, you must prevent micro-organic growth or kill micro-organisms before growth begins.

Ensiling

To prevent micro-organic growth, grain must be treated like silage which means promoting the growth of acid-producing bacteria in the absence of oxygen. These bacteria produce acids by fermenting barley sugars and carbohydrates. The acids (mainly lactic acid) produced stop further bacterial action. A state of preservation results when the acids, produced without oxygen, kill the micro-organisms which cause spoilage.

Horizontal or pit silo

Moisture content and packing of barley when stored are the most important factors in determining the final products. Barley that is too dry and/or not packed properly will have excess oxygen present, and this condition will allow molds and yeasts to continue to work, resulting in ruined feed from excessive mold and rotting. Packing can be improved by rolling or hammering the grain before it is placed in the silo. Combined rolling and packing result in rapid exclusion of oxygen, which creates a favourable environment for acid forming micro-organisms. The open kernels of barley provide a ready source of carbohydrates for acid-forming bacteria to feed on, and rolling at harvest time will eliminate the need for this operation when the grain is fed. At that time grain can be fed directly from the silo.

The best moisture content for barley is 25 to 35 per cent. To determine the correct moisture content a simple hand test is suggested. When squeezed in the hand, some whole barley kernels will stick together, while rolled barley will remain in clumps. If the grain is too dry (less than 25 per cent) it will fall apart in the palm.

Silo sides should be air-tight with a good surface seal maintained until the grain is fed. If air can enter, some molding will take place. In horizontal bunker or pit silos, line the top three feet of silo walls with plastic sheeting which extends over the top surface. However, unless it is held down properly, plastic can pump air into the silage. Cover the plastic with old silage, hay, straw, fish netting or bales placed very close together. Old tires are usually a poor choice as plastic flapping still occurs causing air movement.

After fermentation, high moisture barley is a brownish-yellow colour with an occasional light brown kernel. It has a distinctive fermented odour – a combination malt-alcohol odour. Rolled grain will be more uniform in colour and appear darker.

Freezing temperatures do not affect the feed quality of high moisture barley. At freezing temperatures, some caking will occur on the faces and sides of bunker silos. This condition will be more pronounced if grain has been rolled before ensiling. The cakes are not solid and fall apart when the grain is moved since the moisture is not high enough to form a solid block.

In warm weather, when high moisture barley is exposed to oxygen it will begin to heat and spoilage will occur. Matching the exposed surface area to daily feed requirements by removing three inches of grain daily will reduce spoilage. Once a silo has been opened and barley exposed to oxygen, it should not be recovered. Recovering the pit face after it has been disturbed will only accelerate spoilage.

Upright silo

The best storage method is in the oxygen-limiting upright silo. This type of storage reduces the need for grain to

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contain over 25 per cent moisture. Oxygen-limiting silos eliminate the need to roll barley before storing and to remove three inches per day across the face.

Acid preservation

Organic acids (propionic and acetic) are effective when applied to damp grain at recommended concentrations. They will kill about 90 per cent of the spoilage organisms and will prevent the remaining 10 per cent from growing. Organic acids preserve damp grain without deterioration, although germination is drastically reduced.

Organic acid-treated grain can be stored in any non-corrosive structure. It may be stored in grain bins, on barn floors or in sheds, when other facilities are not available. Treated grain can even be piled on the ground outside if it is protected from moisture. This may be done by first laying plastic on the ground and then covering the pile with more plastic.

Molding of stored grain is encouraged if it is exposed to moisture, dirt or exposed wood surfaces. Floors and all other wood surfaces, concrete floors and walls, which contact stored grain should be painted or covered with plastic. Steel or galvanized bins must be coated to prevent corrosion.

The amount of organic acid needed to preserve grain increases as the moisture content of the grain increases. If treating barley with organic acids, the most economical moisture content is between 18 and 25 per cent.

The following table gives the recommended rates of propionic and acetic acid to apply to high moisture barley. The recommended amount of organic acid must be used. Lesser amounts will permit spoilage and greater amounts will add to the cost of treatment.

Moisture %	Organic acid % by weight	Lb/ton
18	0.8	16.0
20	0.9	18.0
22	1.0	20.0
24	1.15	23.0
26	1.25	25.0

It is essential that the acid preservative be uniformly dispersed over all the grain, and to assure that this happens, special applicators have been developed. One such machine is self contained, with an acid metering system and a short mixing auger. Another type, also with an acid metering system is available for attachment to the farm auger.

In theory, acid treated grain can be store indefinitely, however, at present it is not recommended that grain be stored longer than one year. Acid-treated grain can be processed and put back in storage without spoiling, however elevators will not accept acid treated grain.

The organic acids are nutrients. They are naturally produced in the rumen of sheep and cattle and form part of the diet of these animals. The quality of milk and meat is not affected when acid treated grain is fed.

Advantages of harvesting high moisture barley

- In trials in Montana, extending over four years, harvesting high moisture barley resulted in a 12-day earlier harvest date. In wetter areas, the harvest date would be advanced still further.
- Yield of dry matter per acre increased by 16.7 per cent when compared to mature field dried barley.
  - (a) The increase yield was due to earlier swathing or elimination of swathing entirely.
    - This resulted in less shattering and head breakage by machines.
    - It resulted in a larger harvest of wild oats.
    - There was reduced loss due to bird damage.
    - The loss due to lodging was reduced.
  - (b) The increased yield was due to a reduced exposure to risks.
    - There was less exposure to possible damage due to hail, wind, and snow.
    - There was no yield loss due to barley sprouting in a wet swath.
    - There was a reduced risk of loss from fire in the field.
    - There was substantially reduced possibility of serious bird damage.
  - (c) The increased yield was due to reduced combine losses.
    - The small kernels do not blow out and are utilized.
    - There are fewer cracked or damaged kernels.
    - The immature kernels are saved and utilized.
- When the moisture content of barley is between 25 and 40 per cent it threshes readily. When moisture content is 15 to 25 per cent, threshing is more difficult as the awns do not break off.
- It is not necessary to wait for late maturing patches or second growth to ripen.
- Areas which were wet in the spring can be seeded late and the grain taken off as high moisture feed.
- Combining can continue under more adverse weather conditions, humid periods, morning and evenings when the crop is soaked with dew and even during light showers.
- Since the stubble is left longer in high moisture barley there is less volume to combine.
- Harvesting high moisture barley aids in controlling weeds.

(a) More weed seeds are harvested, especially wild oats which normally shatter before the barley is mature enough to combine safely.

(b) Acid treatment or fermentation in the silo reduces the germination of weed seeds which may be returned to the field in manure.

(c) There is a longer post-harvest period which will permit fall weed control measures.

- The crop in on the field for a shorter period of time. This allows a longer period of time for post harvest cultivation or for stubble pasture.

Advantages of Feeding High Moisture Barley

- High moisture barley is more palatable to feeder cattle. This encourages them to eat at a constant rate, reducing scouring and foundering. Cattle go on feed easier and faster and stay on feed better with high moisture barley.
- Rolled high moisture barley has little dust and fines, and is responsible for a reduction in problems with bloat. Feeding results are similar to those obtained from feeding steam rolled barley.
- When high moisture barley is fed, there is considerably less wind loss from feed bunks.
- The protein content of high moisture barley is at least equal to that of dry grain.
- When high moisture barley is mixed in a feed ration, there is less separation.
- Trials indicate that the rate of gain and feed efficiency of steers and pigs fed rolled high moisture grain was at least equal to those fed on dry barley.
- Processing of high moisture barley for feed, either directly after harvest, or after removal from storage can be done with a roller mill, tub grinder, force feed burr mill or a hammer mill.
- Trials showed that steers made better gains when fed processed high moisture barley than when fed unprocessed high moisture barley. When fed on whole barley steers ate less dry matter, but required substantially more grain for 100 pounds of gain. There was little difference in dressing percentage or carcass grade.
- The fodder quality of the straw will be higher after harvesting high moisture barley.

Disadvantages of High Moisture Barley

- In order that high moisture barley may be stored satisfactorily all oxygen must be excluded or the grain treated with an organic acid.
- High moisture barley must be treated, dried or properly stored immediately after harvesting.
- High moisture grain should be rolled or hammered if it is being stored in a horizontal silo, and this operation could create delays at harvest time.

When handling high moisture barley through a roller mill, scrapers are required on the roller because of the gumming effect. Adjust the rollers only until good flaking occurs. Excessive flaking will cause serious gumming and will make it very difficult to auger the rolled barley. The roller tension should be somewhat less than when rolling dry grain.

Burr mills with force feed augers ahead of the burrs force out any dough that collects, and no problems arise.

When high moisture barley is processed through hammer mills there is no problem with screens or mills plugging, although dough will collect under the screens.

- Under certain weather conditions, barley may all be ready for harvesting at the same time. In this case it may dry down too fast and reconstitution may be required.

Advance planning, seeding different varieties and seeding at different dates will help to reduce this problem.

- High moisture barley is 20 to 25 per cent heavier than dry barley.
- Grain with more than 24 per cent moisture content does not flow readily. Some bridging in the combine and in truck boxes will occur.
- If high moisture barley is straight combined and only the heads are harvested then an excess of straw is left standing. Turning this excess straw back into the soil may be difficult.
- When combining high moisture barley, the combine ground speed will be at least 25 per cent less than if dry grain were being handled. This reduction in speed is necessary to prevent straw walker losses. High moisture straw can carry significant quantities of grain through the combine, high moisture grain does not sift through the straw as readily as does dry grain.
- High moisture barley can only be used for livestock feed. Elevators will not accept either high moisture barley or acid treated grain.
- All bins used to hold acid treated grain must be painted or covered to prevent corrosion or the entrance of moisture which would dilute the preservative.
- As with any chemical, care is required in the use of acid treating materials.

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